TETRA TECH

TECHNICAL MEMORANDUM

To:	Nevada Environmental Response Trust
Cc:	Dan Pastor, Tetra Tech, Inc.
From:	April Hussey
Date:	May 22, 2018
Subject:	Operation and Maintenance Summary – April 2018 Weir Dewatering Treatment Plant Nevada Environmental Response Trust; Henderson, Nevada

The Southern Nevada Water Authority (SNWA) is completing two weir construction projects in the Las Vegas Wash, the Sunrise Mountain Weir and Historic Lateral Weir. SNWA has hired a construction company, Las Vegas Paving (LVP) to perform weir construction activities. This includes constructing diversion channels to divert the Las Vegas Wash and perform construction dewatering activities. The Nevada Environmental Response Trust (NERT or Trust) has been ordered by the Nevada Division of Environmental Protection (NDEP) to treat the groundwater from the construction dewatering activities to remove perchlorate before discharging the treated water to the Las Vegas Wash.

To manage and treat groundwater from the construction activities, Tetra Tech, Inc. (Tetra Tech) designed and constructed two pump stations and a central water treatment plant (CWTP), collectively referred to as the SNWA Weir Dewatering Treatment Plant (Treatment Plant). The Treatment Plant will operate on a temporary basis, and operations will cease once groundwater dewatering associated with the SNWA weir construction projects is complete.

At the direction of NERT, Tetra Tech has prepared this summary of the operation and maintenance (O&M) activities performed during April 2018 for the Treatment Plant. The system was operated and maintained in accordance with the *NERT – SNWA Weir Dewatering Water Treatment Plant Operation and Maintenance Manual*.

SUMMARY OF O&M ACTIVITIES

During April 2018, the Treatment Plant continued to receive water from weir construction dewatering activities at both the Sunrise Mountain and Historic Lateral Weirs.

OPERATIONS

Operations in April 2018 were characterized by intervals of high influent total suspended solids (TSS) concentrations as a result of LVP excavating dewatering trenches and pits. Treatment Plant National Pollutant

Tetra Tech, Inc.
150 S. 4th Street, Unit A, Henderson, NV 89015
Tel 702-854-2295 tetratech.com

Discharge Elimination System (NPDES) water quality samples and influent flowrate monitoring confirmed the operations were in compliance with permit limits during the April 2018 reporting period.

Flow Rates

Flow rates for April 2018 are summarized in Table 1. This includes a summary of the flow rate into the Historic Lateral Pumps Station (HLPS), into the Sunrise Mountain Pump Station (SMPS), and out of the Treatment Plant.

Historic Lateral Pump Station

Flow rates into HLPS are variable based upon the number of dewatering pumps being used by LVP at the Historic Lateral Weir construction site. Each dewatering pump delivers approximately 800 gpm to 1,000 gpm to the HLPS. During April 2018, LVP used up to six pumps at Historic Lateral Weir construction site.

Sunrise Mountain Pump Station

Flow rates into the SMPS were fairly consistent over the reporting period, reflecting consistent dewatering operations by LVP at the Sunrise Mountain Weir construction site using three dewatering pumps.

Influent Parameters

Influent water quality parameters are measured daily for the water coming into each pump station. Influent water quality parameters measured include:

- Perchlorate
- Chlorate
- Total Dissolved Solids (TDS)
- Sulfate
- Nitrate

Perchlorate, chlorate, and TDS are analyzed at a certified laboratory (Test America) in accordance with the Operations and Maintenance Agreement, executed December 31, 2017. Sulfate and nitrate are also analyzed to capture a complete evaluation of these influent parameters. Beginning March 16, 2018, both nitrate and sulfate were analyzed exclusively by the in-house laboratory. Both nitrate and sulfate are analyzed according to EPA method 300.0. These in-house procedures meet the standards specified in the approved NERT project Quality Assurance Project Plan as described in previous monthly reports.

The range and average of perchlorate concentrations observed into each pump station during the reporting period were:

- HLPS: 135 to 273 µg/L, average: 204 µg/L
- SMPS: 760 to 1,510 µg/L, average: 1,116 µg/L

Table 2 contains the summary data from the daily influent parameter measurements.

Perchlorate Mass Removal Estimates

Daily perchlorate mass removal estimates were calculated from the recorded total influent flow to the SMPS and HLPS and daily measurements of perchlorate (analyzed at Test America by Method 314.0). The mass removed was calculated based on an effluent perchlorate concentration of zero (0) µg/L. The estimated mass of perchlorate removed during April 2018 is:

- HLPS: 122 pounds
- SMPS: 822 pounds
- Total: 944 pounds

Perchlorate removal estimates have been tabulated since the startup period ended January 17, 2018. The estimated total perchlorate mass removed from January 18, 2018 through April 30, 2018 is:

- HLPS: 322 pounds
- SMPS: 2,875 pounds
- Total: 3,197 pounds

A graph showing the estimated removal of perchlorate from January 18 through April 30, 2018 is presented in the attached Figure 1.

Suspended Solids Removal and Management

The Treatment Plant was designed to remove the majority of suspended solids from the influent waters via hydrocyclones and multimedia filters (MMF). High TSS waste from the hydrocyclones are stored in the 20,000-gallon cyclone waste tank. High TSS waste from the MMFs is generated during the MMF backwash process and is stored in two 20,000-gallon backwash waste tanks. The system is designed to slowly blend in backwash waste and cyclone waste water into the treated effluent stream in small quantities to ensure the concentrations do not exceed the NPDES permit discharge limits for perchlorate (18 µg/L) and TSS (135 mg/L).

To address the ongoing significant solids loading in the waters produced from weir construction, continued use of external tanks for cyclone and backwash waste surge and storage capacity and associated decanting system occurred in April 2018. These external surge tanks are connected to the permanent cyclone and backwash waste tanks with a semi-permanent hard-pipe system to reduce the potential for releases outside of containment. The piping system maintains all pumps and connections within secondary containment, and includes a pumping circuit to decant the water overlying settled solids from these tanks back into the SMPS influent tanks. In the month of April:

- 2 tanker truckloads of solids slurry were sent to the landfill, or 8,000 gallons of tanker capacity; and
- 1,799,100 gallons of water overlying settled solids were decanted from the surge tanks and routed back through the Treatment Plant (3,173,600 total gallons since start of decanting process).

MAINTENANCE

Maintenance performed at the Treatment Plant during the reporting period included both routine maintenance activities and non-routine maintenance activities as described in the following sections.

Routine Maintenance

Routine maintenance activities included the following:

- Generators supplying power to the SMPS, HLPS, and CWTP require service approximately every 250 hours of generator run time. Generators were serviced during the reporting period as follows:
  - XQ350 – Unit 14-161 (at HLPS), service conducted on April 11, 2018, and April 25, 2018
  - XQ350 – Unit 14-162 (at HLPS), service conducted on April 11, 2018, and April 25, 2018
  - XQ500 – Unit 14-165 (at CWTP), service conducted on April 7, 2018, and April 18, 2018
  - XQ350 – Unit 17-248 (at SMPS), service conducted on April 11, 2018, and April 24, 2018
  - XQ350 – Unit 17-249 (at HLPS), service conducted on April 12, 2018, and April 25, 2018
  - XQ350 – Unit 17-250 (at SMPS), service conducted on April 24, 2018
  - XQ350 – Unit 17-251 (at SMPS), service conducted on April 11, 2018, and April 24, 2018
- Wye strainer was flushed periodically to clear solids accumulation.
- Cyclone underflow lines were flushed periodically to clear solids accumulation.

- Pump oil was changed on Pumps 2A and 2C.
- Tank level sensors were cleaned.

Non-Routine Maintenance

Non-routine maintenance was performed during April 2018 to improve Treatment Plant operation, including:

- Installed drain lines from both Pump 7B and Pressure Release Valve to on-site sump on April 9, 2018.
- Installed new hose and fittings on polymer injection system water tank feed water line from Ion Exchange vessel 2B on April 10, 2018.
- Installed new coupler in Pump 6B on April 11, 2018.
- Installed new Wye Strainer on influent line to CWTP on April 17, 2018.
- Installed new flowmeter on decant line on April 18, 2018.
- Cleaned four temporary solids handling tanks on April 19, 2018, and returned vessels to vendor on April 20, 2018.
- Changed ion exchange resin in vessels 1A and 1B on April 21, 2018.
- Installed new mechanical seal on Pump 7B on April 26, 2018.

O&M Costs

At the direction of the Trust, Tetra Tech has summarized cost data for the reporting period. The following table summarizes project charges in accordance with the Operations and Maintenance Agreement, executed December 31, 2017. This section only captures project charges consistent with the O&M agreement or agreed upon charges for items supplied by/through Tetra Tech and billed to the Trust.

Table 3: O&M Cost Summary

Item	Payment Details	Unit[1]	Cost Invoiced During Reporting Period	Total Costs – Project Inception to Date
Monthly Base Cost	Lump sum payable to Tetra Tech	$297,500 /month	$297,500	$1,190,000
Ion Exchange Resin	Lump sum direct pay from Trust to Evoqua for turn key resin delivery, replacement, transportation and disposal services	$135,755 /vessel which includes: $109,750 /vessel for resin $26,005 /vessel for changeout services and disposal	$0[2]	$0

[1] Unit rates do not include applicable taxes.

[2] The Trust pre-paid a sum during Treatment Plant Construction to pre-purchase the equivalent of 4.5 vessel changeouts of resin to ensure product availability and vendor readiness. As of April 30, 2018, 8 vessel changeouts have occurred. 0 vessel changeouts of resin remained on credit with Evoqua. Charges for the additional 3.5 vessel changeouts of resin have yet to be invoiced by Evoqua.

Item	Payment Details	Unit[1]	Cost Invoiced During Reporting Period	Total Costs – Project Inception to Date
Tankage	Actual usage charges direct pay from Trust to Baker Corp and Rain for Rent	Baker Corp: $20,074 /month plus variable maintenance fees as necessary Rain for Rent: As used	$0[3] $29,240	$105,201
Generator Rental / Maintenance	Actual usage charges direct pay from Trust to Cashman	$625 every 250 run hours per XQ350 Generator $1,250 every 250 run hours per XQ500 plus Backup generator rental costs as required to support maintenance	$13,750[4]	$20,000
Generator Fuel	Actual usage charges direct pay from Trust to Cashman	$3.75 /gal delivered	$226,698	$311,281
Solids Disposal	Lump sum payable to Tetra Tech for off-site transportation and disposal	$4,150 /3,000-gallon tanker $6,917 /5,000-gallon tanker	$83,004	$1,301,771
Decanting	Daily charge	$10,000 /day	$160,000	$250,000
		TOTAL	$810,192	$3,178,253

No other items were supplied by/through Tetra Tech and billed to the Trust during this reporting period.

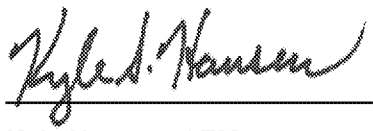
[3] The Trust pre-paid a sum during Treatment Plant Construction for project tankage to obtain a discount on long-term equipment cost. As of April 30, 2018, the remaining credit balance is $134,984.86. Additional payment by the Trust will not be required until this prepayment credit is exhausted.

[4] The Trust pre-paid a sum during Treatment Plant Construction for generator rental to obtain a discount on long-term equipment cost. As of April 30, 2018, the remaining rental credit balance is $141,783.95. Additional payment by the Trust for rental will not be required until this prepayment credit is exhausted. Maintenance costs are separate from the pre-paid sum for rental and are included in the table above.

CERTIFICATION

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been prepared in a manner consistent with the current standards of the profession, and to the best of my knowledge, comply with all applicable federal, state, and local statutes, regulations, and ordinances. I hereby certify that all laboratory analytical data was generated by a laboratory certified by the NDEP for each constituent and media presented herein.

Description of Services Provided: Prepared Weir Dewatering Treatment Plant Operation and Maintenance Summary for April 2018.



May 22, 2018

Kyle Hansen, CEM
Field Operations Manager/Geologist
Tetra Tech, Inc.

Date

Nevada CEM Certificate Number: 2167
Nevada CEM Expiration Date: September 18, 2018

Tables

Weir Dewatering Treatment Plant
Monthly Flow Summary
April 2018
Table 1

Date	Influent						Effluent[3]	
	HLPS		SMPS		Combined Flow[1]			
	Average[2] (FIT3010) gpm	Total (FIT3010) Gallons	Average[2] (FIT2010) gpm	Total (FIT2010) Gallons	Average[2] (FIT4010) gpm	Total (FIT4010) Gallons	Average[2] (FIT8060) gpm	Total (FIT8060) Gallons
4/1/2018	1,333	1,919,300	1,705	2,454,500	3,035	4,370,500	3,286	4,732,100
4/2/2018	1,925	2,771,300	1,993	2,870,100	2,483	3,575,700	4,137	5,956,900
4/3/2018	1,858	2,675,600	2,333	3,358,800	3,336	4,804,200	4,465	6,430,100
4/4/2018	1,554	2,237,400	2,158	3,107,600	3,732	5,374,700	3,960	5,702,700
4/5/2018	1,939	2,792,700	1,925	2,771,900	3,478	5,008,600	4,131	5,948,800
4/6/2018	2,378	3,423,900	2,168	3,122,100	4,567	6,576,600	4,918	7,081,300
4/7/2018	1,921	2,766,100	2,115	3,045,600	4,051	5,833,400	4,499	6,478,700
4/8/2018	1,530	2,202,900	2,105	3,030,700	3,637	5,237,800	4,150	5,976,000
4/9/2018	1,712	2,465,300	2,097	3,020,300	3,873	5,577,800	4,260	6,134,500
4/10/2018	1,637	2,356,700	2,098	3,021,600	3,315	4,772,900	4,167	6,000,500
4/11/2018	1,831	2,636,800	2,063	2,970,800	4,053	5,835,600	4,332	6,237,900
4/12/2018	1,581	2,277,000	1,992	2,868,400	3,612	5,200,600	4,121	5,934,700
4/13/2018	1,747	2,516,100	2,098	3,021,400	3,195	4,600,700	4,365	6,285,300
4/14/2018	1,662	2,393,900	1,852	2,666,900	3,570	5,140,700	4,043	5,821,300
4/15/2018	1,508	2,172,100	1,451	2,089,400	2,996	4,313,800	3,463	4,986,100
4/16/2018	1,642	2,365,100	2,232	3,213,700	3,304	4,757,600	4,231	6,092,900
4/17/2018	1,753	2,523,700	2,085	3,001,700	3,681	5,301,300	4,209	6,061,500
4/18/2018	1,854	2,669,300	2,158	3,107,800	4,121	5,934,000	4,477	6,447,400
4/19/2018	1,853	2,667,600	2,127	3,062,700	4,102	5,906,500	4,423	6,369,100
4/20/2018	1,370	1,973,200	2,124	3,059,000	3,587	5,165,300	4,043	5,822,600
4/21/2018	1,467	2,112,100	2,139	3,079,700	3,677	5,295,300	4,055	5,838,700
4/22/2018	1,508	2,171,800	1,775	2,555,900	3,266	4,702,700	3,638	5,238,300
4/23/2018	1,762	2,537,700	2,011	2,896,300	3,845	5,536,300	4,023	5,793,000
4/24/2018	1,461	2,103,300	2,368	3,410,100	3,820	5,501,000	3,937	5,669,400
4/25/2018	1,432	2,062,600	2,152	3,098,200	3,600	5,184,200	3,867	5,568,100
4/26/2018	1,478	2,128,900	2,124	3,058,200	3,588	5,166,900	3,880	5,587,700
4/27/2018	1,455	2,095,700	1,958	2,819,900	3,424	4,931,200	3,673	5,289,400
4/28/2018	1,469	2,115,800	1,831	2,636,900	3,328	4,792,900	3,587	5,165,100
4/29/2018	1,365	1,965,200	1,890	2,721,900	3,128	4,504,300	3,481	5,012,200
4/30/2018	1,356	1,952,300	2,281	3,284,800	3,652	5,258,700	3,879	5,585,700

Notes:

HLPS = Historic Lateral Pump Station.

SMPS = Sunrise Mountain Pump Station.

FIT numbers presented in column headers correlate with Flow Instrument Transmitter tag numbers for particular flow meters.

Combined flow totals recorded on 4/2, 4/4 - 4/5, 4/9 - 4/13, 4/16 - 4/21 and 4/23 inclusive of bypass of flowmeter for maintenance or recirculated flow through plant decant process.

1 - The combined feed is measured by flow indicator FIT4010. This is not equal to the sum of flows from HLPS (FIT3010) and SMPS (FIT2010) due to fluctuating volumes in influent storage tanks.

2 - Average calculated by dividing total gallons by 1,440 (minutes per 24 hours).

3 - Effluent flow meter data is higher than the combined influent flows due to inherent flowmeter variability and is compounded by batch processing operations. Air drawn into piping (as designed for vacuum breaks) at the end of each pumping batch has been observed to result in transient, short duration high flow readings that are not representative of actual flows.

Weir Dewatering Treatment Plant
Influent Parameter Summary
April 2018
Table 2

Parameter:	Parameter:	Parameter:	Perchlorate		Chlorate		Total Dissolved Solids		Nitrate as NO3		Sulfate		
		Units:	ug/L		ug/L		mg/L		mg/L		mg/L		
Location	Collection Date	Lab Sample ID	Result	LQ	Result	LQ	Result	LQ	Result	LQ	Result	LQ	Comment
HLPS Influent	4/1/2018	440-207819-1	206		69.5		1560		41.6		601		
	4/2/2018	440-207817-1	198		128		1570		41.3		599		
	4/3/2018	440-207958-1	212		129		1570		41.8		607		
	4/4/2018	440-208096-1	170		92.3		1660		46.0		659		
	4/5/2018	440-208209-1	193		138		1680		43.0		657		
	4/6/2018	440-208289-1	177		80.5		1710		44.1		625		
	4/7/2018	440-208406-1	216		72.7		1610		42.0		610		
	4/8/2018	440-208408-1	230		123		1600		41.4		586		
	4/9/2018	440-208410-1	232		99.3		1590		41.7		609		
	4/10/2018	440-208557-1	251		93.3		1600		41.6		622		
	4/11/2018	440-208711-1	241		105		1620		41.6		618		
	4/12/2018	440-208791-1	267		156		1570		41.2		613		
	4/13/2018	440-208901-1	251		154		1580		41.4		608		
	4/14/2018	440-209005-1	220		81.4		1570		42.5		624		
	4/15/2018	440-209002-1	209	F1	95.4		1590		40.2		593		
	4/16/2018	440-209007-1	273		214		1600		40.4		615		
	4/17/2018	440-209159-1	223		164		1670		40.5		616		
	4/18/2018	440-209256-1	158		118		1650		41.6		609		
	4/19/2018	440-209329-1	257		187		1650		43.2		648		
	4/20/2018	440-209485-1	157		172		1590		41.9		594		
	4/21/2018	440-209596-1	178		33.4	J	1620		42.0		585		
	4/22/2018	440-209595-1	181		73.0		1590		42.4		591		
	4/23/2018	440-209589-1	186		83.5		1600		40.7		599		
	4/24/2018	440-209769-1	168		67.0		1600		42.5		587		
	4/25/2018	440-209878-1	178		62.2		1650		42.8		587		
	4/26/2018	440-209993-1	183	F1	65.9		1600		43.6		587		
	4/27/2018	440-210067-1	184		71.4		1570		43.9		585		
	4/28/2018	440-210200-1	199		63.6		1660		43.6		575		
	4/29/2018	440-210204-1	187		75.7		1600		43.0		570		
	4/30/2018	440-210197-1	135		25.1	J	1610		42.9		577		
SMPS Influent	4/1/2018	440-207819-2	1430		216		2900		25.7		1380		
	4/2/2018	440-207817-2	1320		196		2900		25.9		1360		
	4/3/2018	440-207958-2	1150		173		2850		27.3		1280		
	4/4/2018	440-208096-2	1240		151		2640		32.1		1190		
	4/5/2018	440-208209-2	1250		162		2700		29.6		1200		
	4/6/2018	440-208289-2	1260		188		2960		28.9		1310		
	4/7/2018	440-208406-2	1180		155		2710		28.0		1190		
	4/8/2018	440-208408-2	1240		163		2700		28.1		1200		
	4/9/2018	440-208410-2	1120		160		2710		28.9		1210		
	4/10/2018	440-208557-2	1180		152		2680		28.3		1220		
	4/11/2018	440-208711-2	1170		156		2750		28.2		1230		
	4/12/2018	440-208791-2	1140		160		2760		29.0		1240		
	4/13/2018	440-208901-2	1160		167		2700		28.2		1230		
	4/14/2018	440-209005-2	1140		172		2710		29.7		1270		
	4/15/2018	440-209002-2	1370		254		3010		25.8		1380		
	4/16/2018	440-209007-2	1510		264		3200		24.9		1480		
	4/17/2018	440-209159-2	1090		152		2770		29.3		1230		
	4/18/2018	440-209256-2	1060		165		2800		28.2		1240		
	4/19/2018	440-209329-2	1050		171		2730		30.8		1240		
	4/20/2018	440-209485-2	987		13.5	J	2800		27.9		1270		
	4/21/2018	440-209596-1	958		151		2760		29.6		1240		
	4/22/2018	440-209595-1	918		147		2760		29.8		1220		
	4/23/2018	440-209589-2	783		74.7		2420		32.7		1050		
	4/24/2018	440-209769-2	760		179		2810		30.5		1230		
	4/25/2018	440-209878-2	1250		155		2820		29.7		1220		
	4/26/2018	440-209993-2	1140		185		2780		32.8		1280		
	4/27/2018	440-210067-2	977		140		2580		30.7		1190		
	4/28/2018	440-210200-2	912		131		2560		31.1		1120		
	4/29/2018	440-210204-2	797		123		2680		31.0		1170		
	4/30/2018	440-210197-2	930		153		2640		29.2		1210		

Notes:

ug/L	micrograms per liter (parts per billion)
mg/L	milligrams per liter (parts per million)
J	Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
F1	Matrix Spike and/or Matrix Spike Duplicate Recovery is outside acceptance limits.
HLPS	Historic Lateral Pump Station
SMPS	Sunrise Mountain Pump Station

Nitrate data presented as NO_3 consistent with terms of O&M agreement.

Nitrate and sulfate analyzed exclusively by In-House Laboratory beginning 3/16/18.

Figure

Figure 1
Estimated Perchlorate Mass Removed January 18 - April 30, 2018